The claims:

1. A ball penetrometer for in situ measurement of soft soil properties, including:
   a) a spherical body attached to the end of a shaft, the shaft being of substantially smaller diameter than the diameter of the spherical body and being adapted to associate with a module containing an axial force measuring sensor and data transmitter; and,
   b) a sleeve member enclosing the shaft and adapted to isolate the shaft from external soil friction while allowing axial movement of the spherical body and the shaft.

2. The penetrometer as claimed in claim 1, wherein at least part of the surface of the spherical body is provided with or formed of a porous material, the spherical body also including at least one passage providing for fluid communication between the porous material and a pressure sensor.

3. The penetrometer as claimed in claim 2, wherein the porous material is provided as a circumferential porous ring.

4. The penetrometer as claimed in claim 3, wherein the pressure sensor measures pore water pressure of the soil in contact with the porous ring.

5. The penetrometer as claimed in any one of the claims 1 to 4, wherein the axial force measuring sensor is bi-directional.

6. The penetrometer as claimed in any one of the claims 1 to 5, wherein at least one flexible sealing member associates the sleeve member with the spherical body, and at least one flexible sealing member associates the sleeve member with housing of the module.

7. The penetrometer as claimed in either claim 2 or 3, wherein the pressure sensor is located within the module and the shaft includes at least one passage providing fluid communication to the pressure sensor.

8. The penetrometer as claimed in either claim 2 or 3, wherein there is provided more than one passage arranged radially.

9. The penetrometer as claimed in any one of the claims 1 to 8, wherein the module is an electronics module.

10. The penetrometer as claimed in claim 9, wherein the penetrometer is interchangeable between different types of electronics modules.

11. The penetrometer as claimed in claim 6, wherein the at least one flexible sealing member is at least one o-ring.

12. The penetrometer as claimed in any one of the claims 2 to 11, wherein the spherical body is constructed from two hemispherical bodies that together define the at least one passage.

13. A ball penetrometer for in situ measurement of soft soil properties, including:
    a) a spherical body attached to the end of a shaft, the shaft being of substantially smaller diameter than the diameter of the spherical body and being adapted to associate with a module containing an axial force measuring sensor and data transmitter; and,
    b) at least part of the surface of the spherical body provided with or formed of a porous material, the spherical body also including at least one passage providing for fluid communication between the porous material and a pressure sensor.

14. The penetrometer as claimed in claim 13, including a sleeve member enclosing the shaft and adapted to isolate the shaft from external soil friction while allowing axial movement of the spherical body and the shaft.

15. The penetrometer as claimed in either claim 13 or 14, wherein the porous material is provided as a circumferential porous ring.

16. The penetrometer as claimed in any one of the claims 13 to 15, wherein the pressure sensor measures pore water pressure of the soil in contact with the porous ring.

17. The penetrometer as claimed in any one of the claims 13 to 16, wherein the axial force measuring sensor is bi-directional.

18. The penetrometer as claimed in claim 14, wherein at least one flexible sealing member associates the sleeve member with the spherical body, and at least one flexible sealing member associates the sleeve member with housing of the module.

19. The penetrometer as claimed in any one of the claims 13 to 18, wherein the pressure sensor is located within the module and the shaft includes at least one passage providing fluid communication to the pressure sensor.

20. The penetrometer as claimed in any one of the claims 13 to 19, wherein there is provided more than one passage arranged radially.

21. The penetrometer as claimed in any one of the claims 13 to 20, wherein the module is an electronics module.

22. The penetrometer as claimed in claim 21, wherein the penetrometer is interchangeable between different types of electronics modules.

23. The penetrometer as claimed in claim 18, wherein the at least one flexible sealing member is at least one o-ring.

24. The penetrometer as claimed in any one of the claims 13 to 23, wherein the spherical body is constructed from two hemispherical bodies that together define the at least one passage.

25. A penetrometer for in situ measurement of soft soil properties, including:

a) an ellipsoidal body attached to the end of a shaft, the shaft being of substantially smaller diameter than the diameter of the ellipsoidal body and being adapted to

associate with a module containing an axial force measuring sensor and data transmitter; and,

b) a sleeve member enclosing the shaft and adapted to isolate the shaft from external soil friction while allowing axial movement of the ellipsoidal body and the shaft.

26. A penetrometer for in situ measurement of soft soil properties, including:

a) an ellipsoidal body attached to the end of a shaft, the shaft being of substantially smaller diameter than the diameter of the ellipsoidal body and being adapted to associate with a module containing an axial force measuring sensor and data transmitter; and,

b) at least part of the surface of the ellipsoidal body provided with or formed of a porous material, the ellipsoidal body also including at least one passage providing for fluid communication between the porous material and a pressure sensor.

27. A method of in situ measurement of soft soil properties using a ball penetrometer, the ball penetrometer including a spherical body attached to an end of a shaft, the shaft being of substantially smaller diameter than the diameter of the spherical body and being adapted to associate with a module containing an axial force measuring sensor and data transmitter, and a sleeve member enclosing the shaft, the method including the steps of:

a) forcing the ball penetrometer to penetrate a soil bed at a known rate;

b) measuring the force resisting penetration of the spherical body into the soil bed; and,

c) transmitting measurement data to a remote operating station for processing.

28. A method of in situ measurement of soft soil properties using a ball penetrometer, the ball penetrometer including a spherical body attached to an end of a shaft, the shaft being of substantially smaller diameter than the diameter of the spherical body and being adapted to associate with a module containing an axial force measuring sensor and data transmitter, and at least part of the surface of the spherical body provided with or formed of a porous material, the spherical body also including at least one passage providing for fluid communication between the porous material and a pressure sensor, the method including the steps of:

a) forcing the ball penetrometer to penetrate a soil bed at a known rate;

b) measuring the force resisting penetration of the spherical body into the soil bed;

c) measuring the pore water pressure of the soil in contact with the porous material; and,

d) transmitting measurement data to a remote operating station for processing.

29. The method as claimed in either claims 27 or 28, wherein additional steps are provided between steps (b) and (c) as:

b1) withdrawing the ball penetrometer from the soil bed at a known rate; and

b2) measuring the force resisting removal of the spherical body from the soil bed.

30. The method as claimed in claim 27, wherein at least part of the surface of the spherical body is provided with or formed of a porous material, the spherical body also including at least one passage providing for fluid communication between the porous material and a pressure sensor, and the method includes measuring the pore water pressure in contact with the porous material.

31. The method as claimed in any one of the claims 27 to 30, wherein measurements are taken as a function of depth into the soil bed or of time.

32. The method as claimed in any one of the claims 27 to 31, wherein the ball penetrometer is deployed from an apparatus on the seafloor.

33. The method as claimed in claim 32, wherein a connector rod or series of connector rods are provided to facilitate deployment of the ball penetrometer and progressively extend penetration into the seabed.

34. The method as claimed in any one of the claims 27 to 33, wherein the measurement data is transmitted wirelessly from the module to a remotely operated seabed system.

35. The method as claimed in any one of the claims 27 to 34, wherein the ball penetrometer is deployed via a wireline drillstring and measurement data is transmitted to the remote operating station via a wired electrical connection.